10/815,250

Cofc

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT : Michael D. Gandrud
PATENT NO.: 7,038,339
ISSUED : May 2, 2006
TITLE : METHOD AND MEANS OF SEALING AN ELECTRICAL CONDUCTOR THROUGH THE HOUSING OF A FLUID FILLED MOTOR
Docket No.: P06720US0

REQUEST FOR CERTIFICATE OF CORRECTION FOR PATENT NO. 7,038,339 UNDER 37 CFR § 1.322 (a)

Mail Stop - Certificate of Correction
Commissioner of Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

It is requested that the Commissioner issue a Certificate of Correction for the above-identified patent. A soft copy of the patent is attached.

Attached in duplicate is Form PTO/SB/44 (04-05) with at least one copy being suitable for printing. The exact column number and line number where the error occurred in the patent is shown below:

Column, 4, line 28, strike the word "motor" and insert - power unit -.

CERTIFICATE OF MAILING (37 C.F.R. § 1.8(a))

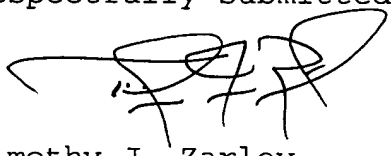
I hereby certify that this document and the documents referred to as enclosed therein are being deposited with the United States Postal Service as First Class mail addressed to: Mail Stop: Certificate of Correction; Commissioner for Patents, Alexandria, VA 22313-1450, on ~~this 10~~th day of May, 2006.

Timothy J. Zarley

Since this was a Patent Office error no government fee is required. If any fees are believed to be due in connection with this request, charge any additional fees to Deposit Account 50-2098.

Accordingly, it is requested that the Certificate of Correction issue. Please send the Certificate to the undersigned.

Respectfully submitted,



Timothy J. Zarley
Reg. No. 45,253
ZARLEY LAW FIRM, P.L.C
Capital Square
400 Locust Street, Suite 200
Des Moines, IA 50309-2350
Phone No. (515) 558-0200
Fax No. (515) 558-7790
Customer No. 34082
Attorneys of Record

TJZ-ref

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Approved for use through 04/30/2007 OMB 0651-0033
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(Also Form PTO-1050)

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 7,038,339

APPLICATION NO. : Serial No. 10/815,250

ISSUE DATE : May 2, 2006

INVENTOR(S) : Michael D. GANDRUD

It is certified that an error or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 4, line 28, strike the word "motor" and insert – power unit -.

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Timothy J. Zarley
ZARLEY LAW FIRM P.L.C.
Capital Square
400 Locust Street, Suite 200
Des Moines, IA 50309-2350

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U.S. Patent and Trademark Office; DEPARTMENT OF COMMERCE

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400 Locust Street, Suite 200
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MAY 17 2006

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(12) **United States Patent**
Gandrud

(10) **Patent No.: US 7,038,339 B2**
(45) **Date of Patent: May 2, 2006**

(54) **METHOD AND MEANS OF SEALING AN ELECTRICAL CONDUCTOR THROUGH THE HOUSING OF A FLUID FILLED MOTOR**

(75) Inventor: **Michael D. Gandrud**, Ames, IA (US)

(73) Assignee: **Sauer-Danfoss Inc.**, Ames, IA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 70 days.

(21) Appl. No.: **10/815,250**

(22) Filed: **Mar. 31, 2004**

(65) **Prior Publication Data**

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(51) **Int. Cl.**
H02K 5/10 (2006.01)

(52) **U.S. Cl.** **310/85**; 310/71; 439/559

(58) **Field of Classification Search** ..... 310/71, 310/85, 68 D, 68 R; 439/559, 569
See application file for complete search history.

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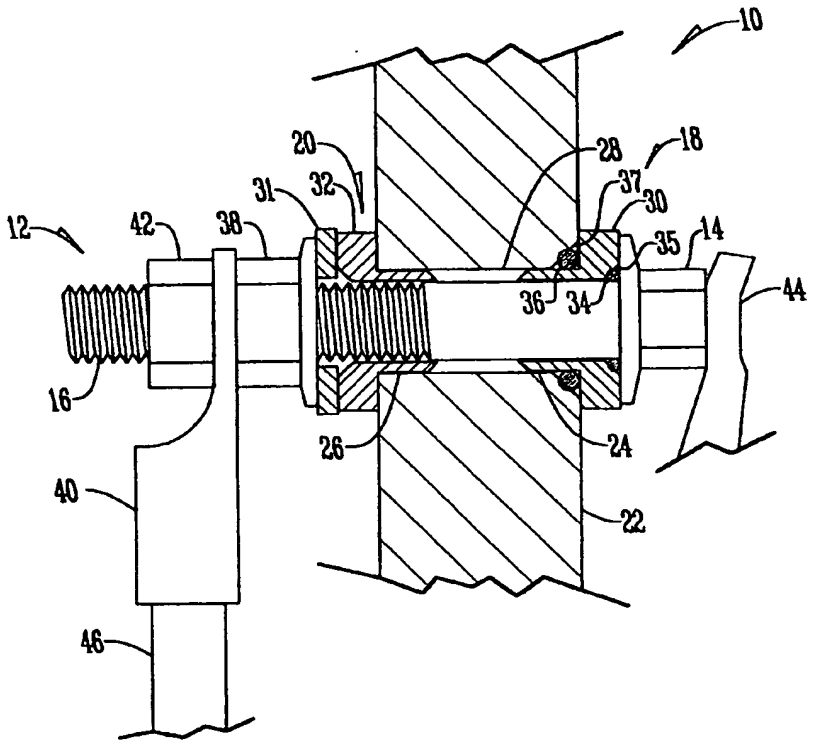
* cited by examiner

Primary Examiner—Darren Schuberg
Assistant Examiner—Nguyen Hanh

(57) **ABSTRACT**

An electrical conductor is provided for a fluid filled motor having a housing. The electrical conductor comprises insulating elements received by a passage extending through the housing, and a terminal bolt passing through the insulating elements. The electrical conductor further comprises sealing means between the terminal bolt, insulating elements, and the housing, and a fastening nut secured to the terminal bolt compressing the sealing means to seal against fluid flow through the passage. A method of sealing said electrical conductor through the housing of a fluid filled motor also is provided.

10 Claims, 5 Drawing Sheets



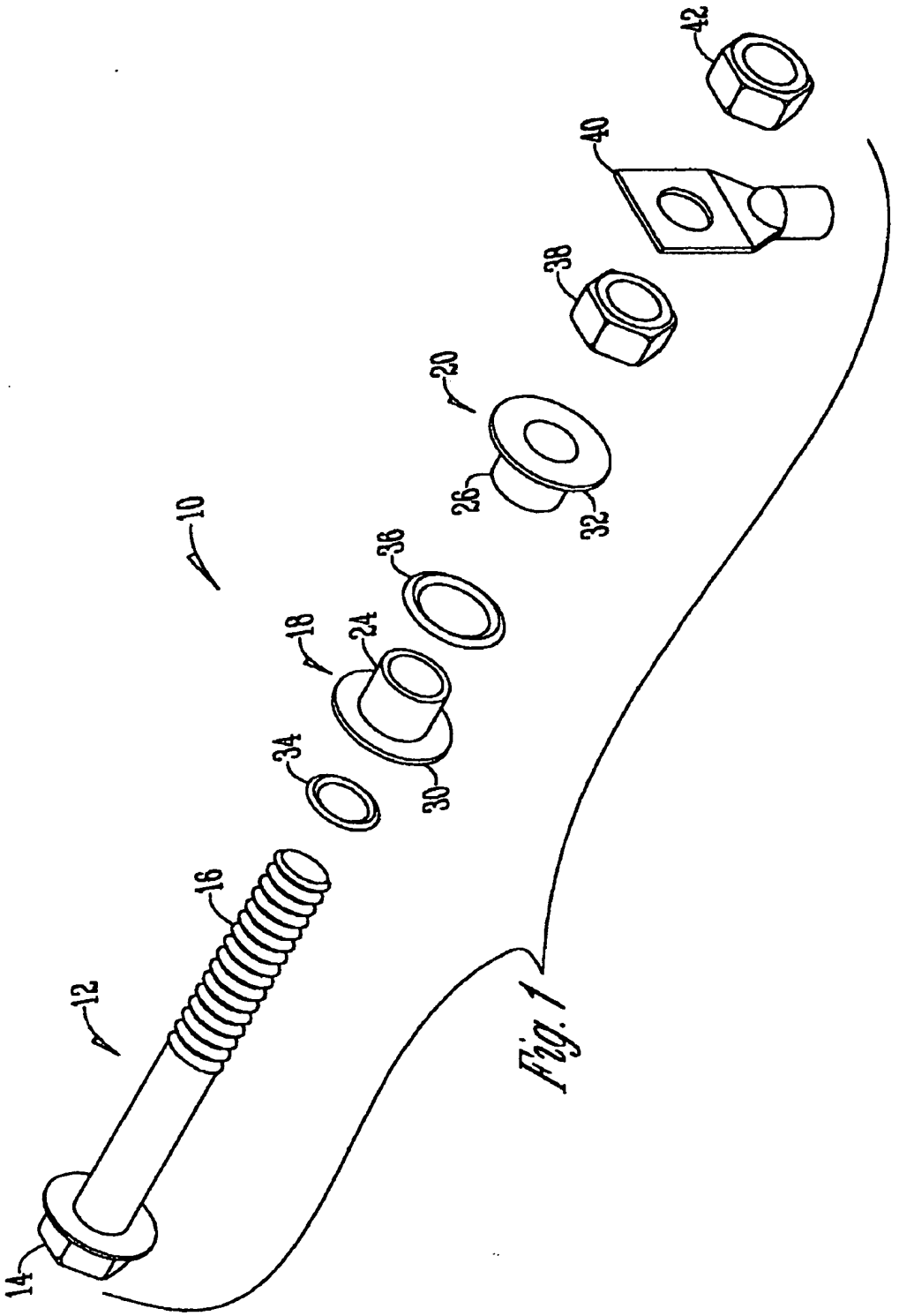


Fig. 1

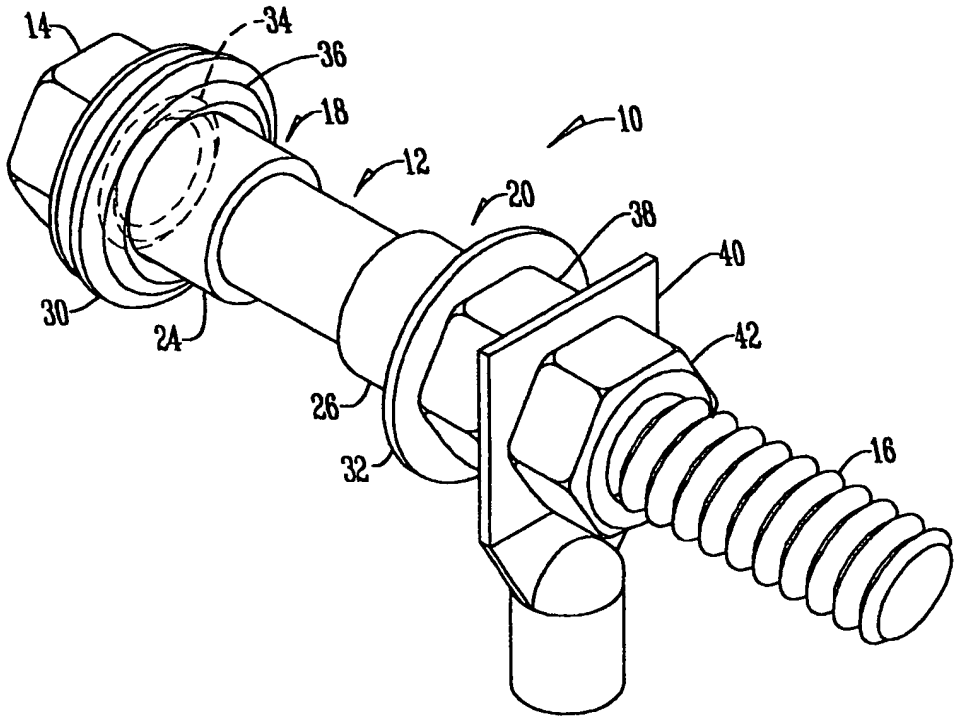


Fig. 2

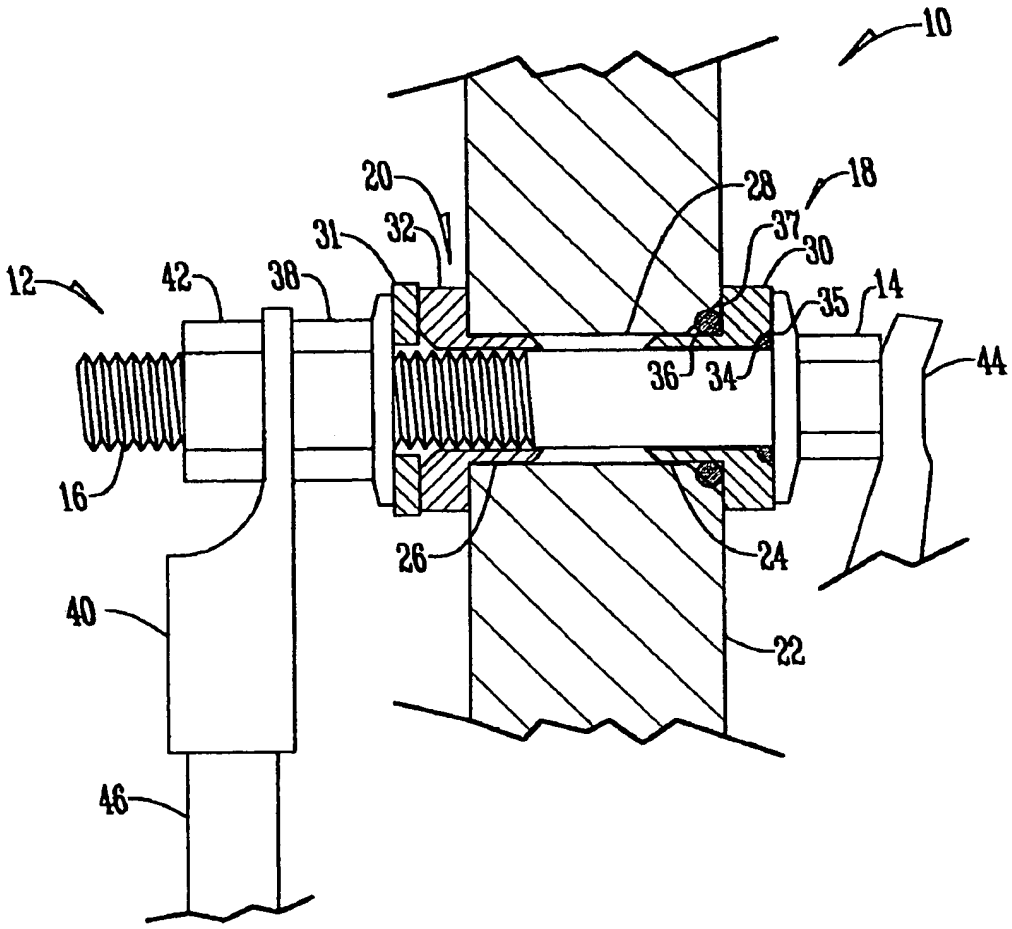


Fig. 3

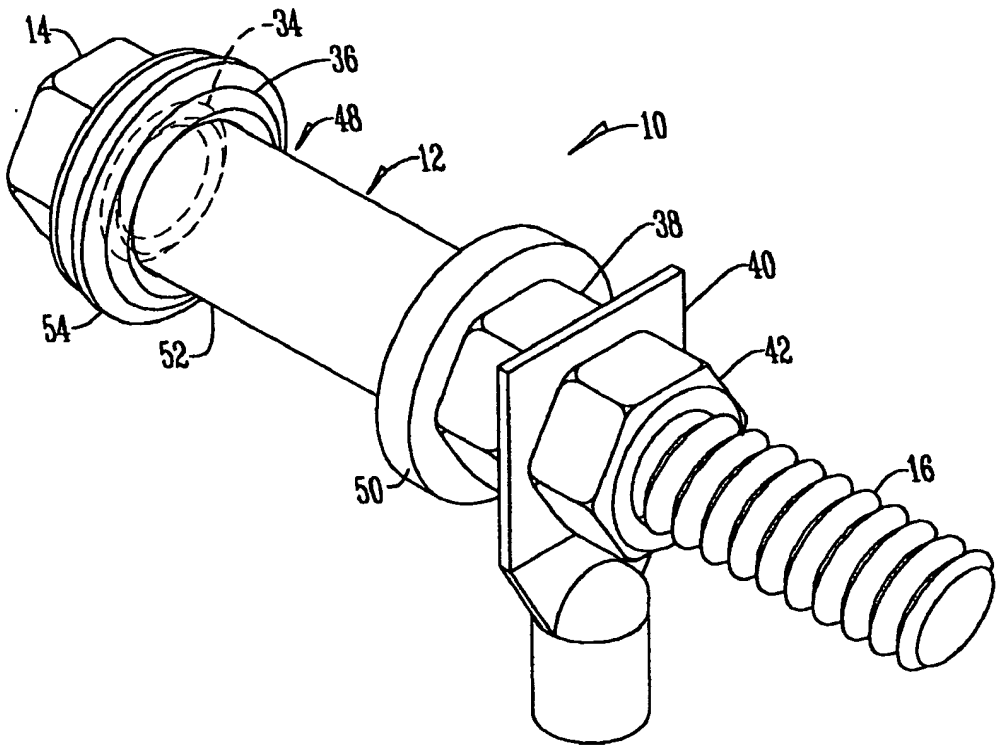


Fig. 4

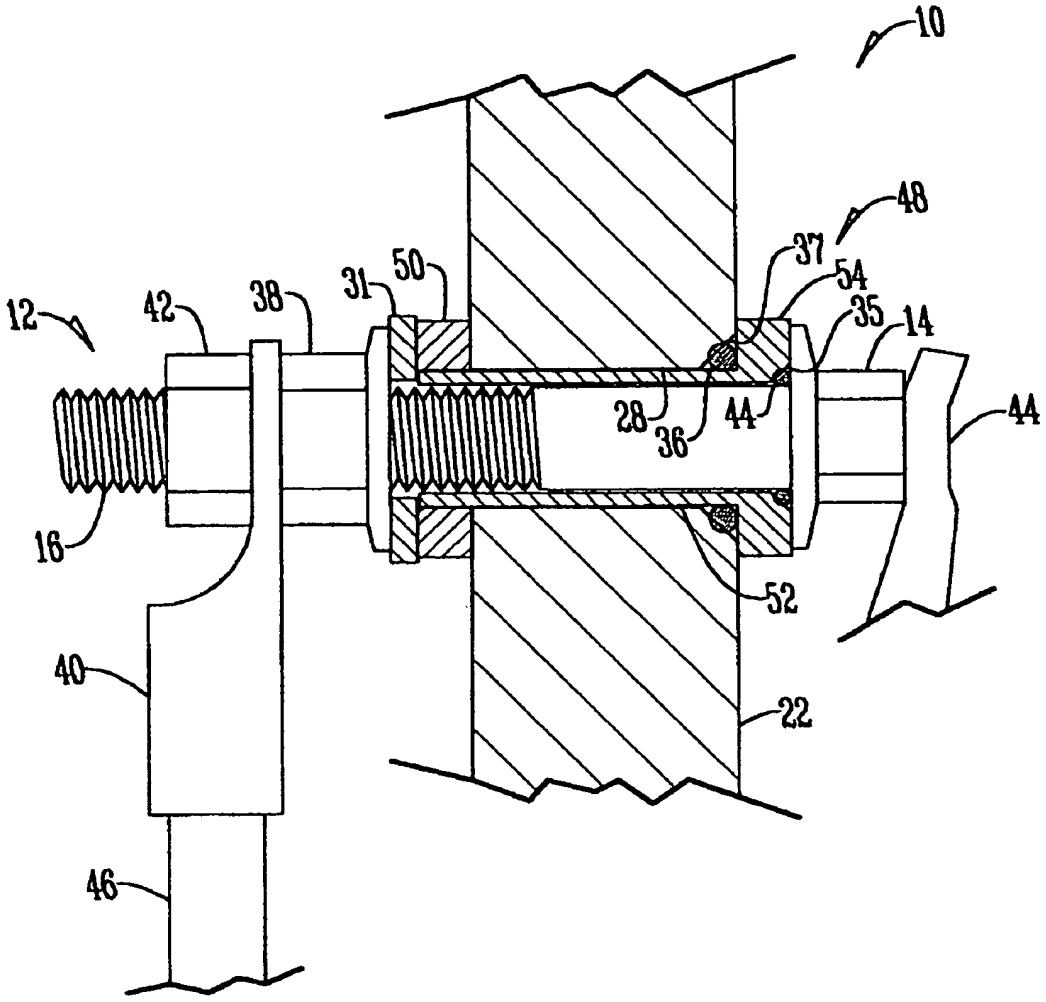


Fig. 5

METHOD AND MEANS OF SEALING AN ELECTRICAL CONDUCTOR THROUGH THE HOUSING OF A FLUID FILLED MOTOR

BACKGROUND OF THE INVENTION

The present invention relates to electrical conductors and, more specifically, to electrical conductors for fluid filled power units.

Power units are used in many types of mobile machinery. Hydraulic machines such as hydraulic pumps and hydraulic motors are typical examples of power units. Electrical machines such as electrical motors, generators, and alternators are also commonly used power units. Power units such as electrical motors are commonly used to power mobile machinery and are oftentimes flooded or cooled with hydraulic fluid or other fluids. In some instances, these electrical motors are completely submerged in the fluid for improved cooling and thereby allow more power to be produced by a motor of a specific size while preventing damage to the motor from such increased power levels. Because of this, the components of electrical motors are enclosed in a leakproof housing. As such, it is necessary to provide a means for connecting the electrical wires that provide power to the motor through the housing while sealing against leakage of the hydraulic or other fluid through this connection. Further, as the housing typically is made of metal or other conductive materials, it is necessary to insulate the electrical connections from the housing. The same need applies not only to electrical motors but to all electrical machines used in mobile machinery, as well as, to hydraulic machines such as hydraulic pumps and hydraulic motors.

U.S. Pat. No. 3,850,501 to Butterfield et al. discloses a feedthrough electrical terminal for use in a liquid cooled shaft. Butterfield et al. accomplishes a leakproof and insulated connection through the use of non-metallic bushings and washers compressed by a threaded female terminal member. The disadvantage Butterfield et al. is that such a design requires numerous components, many of which are non-standard and must be custom machined.

U.S. Pat. No. 4,822,473 to Arnesen and U.S. Pat. No. 6,657,336 to Morikaku et al. both disclose electrical connectors that are comprised of standard pieces of hardware. Specifically, both of these patents disclose the use of standard terminal bolts as conductors. Morikaku et al. also discloses the use of insulating elements to protect the terminal bolt conductor from the metallic housing. The disadvantage of both of these designs is that they are both susceptible to leakage. As such, Arnesen and Morikaku et al. would not be useful in the specific application of a fluid filled power unit.

U.S. Pat. No. 4,614,397 to Flanigan discloses a terminal plate assembly that teaches the use of a terminal bolt as a conductor. Further, Flanigan teaches the use of terminal blocks that serve to both insulate and seal the bolt. The disadvantage of the Flanigan assembly is that it requires the use of intricately machined terminal blocks to accomplish a leakproof seal.

It is therefore a principal object of this invention to provide an electrical conductor for passing through the housing of a fluid filled power unit that is insulated from the housing and utilizes a minimal number of parts.

A further object of this invention is to provide sealing means to prevent leakage from the fluid filled power unit through the electrical conductor.

These and other objects will be apparent to those skilled in the art.

BRIEF SUMMARY OF THE INVENTION

The present invention is directed towards an electrical conductor for a fluid filled power unit having a housing. The electrical conductor comprises insulating elements received by a passage extending through the housing, and a terminal bolt passing through the insulating elements. The electrical conductor further comprises sealing means between the terminal bolt, insulating elements, and the housing, and a fastening nut secured to the terminal bolt compressing the sealing means to seal against fluid flow through the passage.

The present invention also is directed towards a method of sealing said electrical conductor through the housing of a fluid filled power unit.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an exploded perspective view of an assembled electrical conductor of the present invention;

FIG. **2** is a perspective view of an electrical conductor of the present invention;

FIG. **3** is a cross-sectional view of an electrical conductor passing through the housing of a fluid filled power unit of the present invention;

FIG. **4** is an exploded perspective view of an alternative embodiment of the electrical conductor of the present invention; and

FIG. **5** is a cross-sectional view of an alternative embodiment of the electrical conductor passing through the housing of a fluid filled motor of the present invention.

DESCRIPTION OF THE INVENTION

With reference to the drawings, particularly FIGS. **1** and **2**, an electrical conductor **10** is shown which comprises a terminal bolt **12** having a bolt head **14** and a threaded portion **16**. Terminal bolt **12** preferably is made of copper or brass to improve electrical conductivity. Terminal bolt **12** is preferably a flange type bolt.

Insulating elements **18** and **20** insulate the terminal bolt **12** from the motor housing **22** (FIG. **3**). Insulating elements **18** and **20** have substantially cylindrical portions **24** and **26** that are received within the bore **28** of housing **22**. Insulating elements **18** and **20** also have flange portions **30** and **32** that engage with housing **22**.

Sealing means **34** and **36** are positioned about the terminal bolt **12** and insulating element **18** to form a seal between terminal bolt **12**, insulating element **18**, and bore **28** in housing **22**. Sealing means **34** and **36** are preferably O-rings appropriately sized such that O-ring **34** forms a seal between terminal bolt **12** and insulating element **18** and O-ring **36** forms a seal between insulating element **18** and bore **28**. Alternatively, sealing means **34** and **36** may be comprised of resilient washers. Sealing means **34** and **36** are received into optional O-ring groves **35** and **37**.

Fastening nut **38** engages with threaded portion **16** of terminal bolt **12** to tighten the electrical conductor **10** about the housing **22** and compress sealing means **34** and **36** to form a seal between terminal bolt **12**, insulating element **18**, and bore **28**. Nut **38** preferably is made of copper or brass to improve the conductivity of the electrical conductor **10**.

Wire terminal **40** fits over threaded portion **16** of terminal bolt **12** and engages with Nut **38**. Nut **42** is threadably received by terminal bolt **12** to tighten wire terminal **40**

firmly against nut **38**. Optional washer **31** provides a reduced friction surface while tightening nut **38**.

Cables **44** and **46** are attached to the electrical conductor **10** such that electrical current provided by cable **46** passes through the electrical conductor **10** and is received by cable **44**. Cable **44** is optionally composed of a plurality of electrical motor stator coil conductors that are collectively attached to terminal bolt **14**. Alternatively, cable **44** or the motor coil wires that compose cable **44** are attached to a wire terminal that is further attached to terminal bolt **14**. Specifically, cable **44** is attached to the head **14** of terminal bolt **12** by welding, brazing, soldering, or any other conventional method of attachment. Resistance welding of the cable **44** to the terminal may provide improved reliability for many machines. Cable **46** is received by wire terminal **40**, which is securely fastened to the electrical conductor **10**. Alternatively, terminal **40** and cable **46** are replaced with a conductive metal bar such as a copper bar, an aluminum bar, or a plated copper or aluminum bar.

In an alternative embodiment, the electrical conductor **10** may include insulating elements **48** and **50**, as shown in FIGS. **4** and **5**. Insulating element **48** is comprised of a substantially cylindrical portion **52** that is received within the bore **28** of housing **22** and extends the entire length of the bore **28** and protrudes slightly from housing **22**. Insulating element **48** also has a flange portion **54** that engages with housing **22**. Insulating element **50** comprises a non-metallic washer that has an inner diameter greater than the outer diameter of substantially cylindrical portion **52** of the insulating element **48**. Insulating element **50** is received by the end of the cylindrical portion **52** of the insulating element **48** and is tightened against housing **22** by fastening nut **38**, as best shown in FIG. **5**.

Persons skilled in the art will see that while tightening nut **38**, it may be desirable to provide a means to prevent bolt **12** from undesired turning. This is accomplished by adding non-circular bores to housing **22** and insulator **18** which prevent the bolt head **14** from turning within the insulator **18** and further prevent the insulator from turning with respect to the housing **22**. Alternatively, the end of the threaded portion **16** of bolt **12** is provided with a toolable geometry, such as, for example, a screwdriver slot. As such, a wrench is used to tighten nut **38** while a screwdriver is used to prevent rotation of bolt **12**. Alternatively, this toolable geometry may comprise wrench flats or a hex geometry at the threaded end **16** of bolt **12**, or a female hex or another female geometry provided within the threaded end **16** of bolt **12**.

Sealing means **34** or **36** are optionally molded onto either the terminal bolt **12** or the insulator **18** respectively. Such a method is desirable as the number of loose parts is reduced.

The insulating elements **18**, **20**, **48**, and **50** may comprise a plurality of holes for receiving bolts **12** and a plurality of substantially cylindrical portions **24**, **26**, and **52**. Such a system is desirable because only a single insulating element is required on each side of the housing **22** rather than providing a pair of insulating elements for each electrical conductor assembly **10**. Alternatively, insulating elements **18**, **20**, **54**, and **50** may comprise a resilient or elastomeric material. Such insulators are optionally provided with integral sealing means, thereby reducing the number of parts.

In operation, the electrical conductor **10** is used to pass electrical power through a fluid filled power unit housing **22**, as shown in FIG. **3**. As such, the electrical conductor **10** provides power to electrical components (not shown) within housing **22**. Insulating elements **18** and **20** are inserted within the bore **28** of housing **22**, and sealing means **36** provides for a leakproof seal between insulating element **18** and bore **28**. Terminal bolt **12** passes through insulating elements **18** and **20**, and sealing element **34** provides for a leakproof seal between terminal bolt **12** and insulating element **18**. Fastening nut **38** is secured to terminal bolt **12** such that the electrical conductor **10** is tightened about the housing **22** to compress sealing means **34** and **36**. Nut **42** secures to terminal bolt **12** to tighten wire terminal **40** or a conductive metal bar (not shown) against nut **38**. Cables **44** and **46** are attached to the electrical conductor **10** such that power from cable **46** flows through the electrical conductor **10** and is received by cable **44**. Accordingly, the electrical conductor **10** transfers power from outside of power unit housing **22** to electrical components (not shown) inside without allowing hydraulic fluid to leak through bore **28**.

It is therefore seen that by the use of a sealing means, this invention permits an electrical conductor to pass through the housing of a fluid filled motor without leakage.

What is claimed is:

1. An electrical conductor for a fluid filled power unit comprising:

a motor housing;

insulating elements received by a passage extending through the housing;

a terminal bolt passing through the insulating elements and having a head;

a first sealing means between the head of the terminal bolt and the insulating elements;

a second sealing means between the insulating elements and the housing; and

a fastening nut secured to the terminal bolt compressing the sealing means to seal against fluid flow through the passage.

2. The electrical conductor of claim **1** further comprising a wire terminal secured to the terminal bolt.

3. The electrical conductor of claim **1** wherein an electrical cable is secured to the head of the terminal bolt.

4. The electrical conductor of claim **2** wherein an electrical cable is secured to the wire terminal.

5. The electrical conductor of claim **1** wherein the first sealing means is an O-ring.

6. The electrical conductor of claim **1** wherein the power unit is an electrical machine.

7. The electrical conductor of claim **6** wherein the electrical machine is an electric motor.

8. The electrical conductor of claim **1** further comprising interlocking means to prevent undesired rotation of the terminal bolt.

9. The electrical conductor of claim **1** wherein the insulating elements comprise an elastromeric material.

10. The electrical conductor of claim **9** wherein the insulating elements have O-ring geometries.

* * * * *